

Research Summary

A Roadmap for Missouri: Assessing Needs an Implementation Framework for Incorporating Environmental Product Declarations

The Missouri Department of Transportation's (MoDOT) Climate Challenge project focused on two construction materials – asphalt and concrete. The primary goal of this project was to identify the key gaps in the implementation of Environmental Product Declarations (EPDs) across the construction industry and, to the extent possible, bring the industry up to speed with the latest developments. To that end, the researchers conducted a review of the existing literature and conducted benchmarking studies for asphalt and concrete mixtures in Missouri.

Missouri's asphalt EPDs published through the National Asphalt Pavement Association's (NAPA) Emerald Eco-Label EPD tool were used to come up with state-specific Global Warming Potential (GWP) benchmarks. GWP data from 86 EPDs were considered. As per EPA's interpretation of low carbon materials, the top 20%, 40% and 50% best-performing limits and average GWP values were quantified. For the acquisition of materials stage (A1), the mixtures were categorized based on the type of mixture or binder modifiers used in the mixture.



Benchmarks were quantified for mixture categories that had sufficient data points, namely, virgin mixtures, mixtures with reclaimed asphalt pavement (RAP), and mixtures with RAP and polyphosphoric acid (PPA). Other mixture categories with fewer than five data points included mixtures exclusively with or with a combination of styrene-butadiene-styrene (SBS), PPA, recycled asphalt shingles (RAS), and lime filler. Assessing the average A1 GWP values of the mixture categories, it was found that the use of RAP in asphalt mixtures can reduce GWP emissions by 16% compared to virgin mixtures, while mixtures with RAP and PPA saw GWP reductions of 6%. NAPA's recently published reference values for Missouri were comparable to the values computed in this study. The transportation phase (A2) GWP benchmarks quantified for Missouri were marginally higher than NAPA's reference values for the wet-freeze zone and the benchmarks for all states collectively, excluding Florida and Louisiana. While the product manufacturing phase (A3) GWP benchmarks for Missouri were higher than NAPA's A3 benchmarks for the wet-freeze zone, limited asphalt plant data was available in the Missouri EPDs. Only seven data points were considered for the evaluation of the A3 benchmarks, resulting in an inaccurate representation of the GWP emissions of asphalt plants in the region.



The National Ready Mix Concrete Association (NRMCA), as the program operator for concrete mixtures, has undertaken initiatives towards lowering GHG emissions in concrete mixture production by establishing GWP baselines for cradle-to-gate (A1-A3) life cycle stages of concrete. The baselines were assessed using the Building Transparency ED3 tool. This tool contains a repository of EPDs which are provided by various US program operators. The Missouri EPDs were compared with NRMCA regional baselines and the US General Services Administration benchmarks for cement and concrete. The top 20%, 40%, and 50% best-performing limits and average GWP values were quantified. A total of 17 Missouri-specific EPDs were considered for this study. Since A1 cementitious materials contribute 85% of the total GWP of the mixture production, optimizing the amount and the composition of the cementitious materials produces the greatest GWP reduction to a concrete mixture. As such, the A1 GWP embodiment of the Missouri B, B-1, B-2, MB-2, and Portland Cement Concrete Pavement (PCCP) mixes from data provided by MoDOT, were assessed assuming a 2020 baseline. None met the criteria for the GSA top 20% classification of <284 kgCO₂e. B and MB-2 met the top 40% classification of <326 kgCO₂e, and all but B-2 met the top 50% classification of <352 kgCO₂e. When the assessment is updated to the current practice of using ASTM C595 Type IL cement, B and MB-2 mixtures achieve the top 20% classification with B-1 and PCCP meeting the top 40% classification. Additional scenarios were evaluated to include various levels of supplemental cementitious materials (SCM) currently allowed and consideration of performance engineered mixtures for concrete pavement. With current practice updates, most mixture classifications were able to achieve the GSA'S best 20% performance benchmark.

Project Information

PROJECT NAME: TR202324—FHWA Climate Challenge – Missouri Department of Transportation

PROJECT START/END DATE: March 2023-February 2025

PROJECT COST: \$390,000

LEAD CONTRACTOR: University of Missouri-Kansas City

PRINCIPAL INVESTIGATORS: John Kevern, Bill Buttler

REPORT NAME: A Roadmap for Missouri: Assessing Needs and Implementation Framework for Incorporating Environmental Product Declarations

REPORT NUMBER: cmr 25-002

REPORT DATE: February 2025

Project Manager



CONTACT INFORMATION:

Jenni Hosey, AICP, PMP
Senior Research Analyst
Missouri Dept. of Transportation
1617 Missouri Blvd.
Jefferson City, MO 65109
(573) 526-4493
Jennifer.J.Hosey@modot.mo.gov

